AXILLARY ARTERY–CORONARY ARTERY BYPASS GRAFTING

Eduardo A. Tovar, MD, Nathan Blau, MD, and Alan Borsari, MD, *Fullerton and Orange, Calif.*

Recently, an operation first described in 1952 by Demikhov[1] and further developed by Kolesov and Potashov[2] has reemerged as a minimally invasive procedure in which the left internal thoracic artery (LITA) is anastomosed to the left anterior descending coronary artery (LAD) in a beating heart. An anterior mediastinotomy is used to gain access to both arteries. We, like others,[3] have used the descending thoracic aorta and the left subclavian artery as inflow conduits to perform coronary bypass procedures without extracorporeal circulation. Recently, however, we encountered a case in which these sources of inflow could not be used. We had to resort to the axillary artery to perform the proximal anastomosis. To tunnel the graft into the chest cavity, we resected the anterior portion of the first rib and performed the rest of the operation through an anterior mediastinotomy.

A 63-year-old man was admitted with congestive heart failure, severe pulmonary edema, and liver and renal dysfunction. The patient had undergone three previous coronary bypass operations. The most recent one, in 1995, was performed on an urgent basis after failure of a stent to reopen the anastomotic site between the LITA and the LAD. According to the surgeon's operative note at the specialized stent center, the patient had a complicated operation that required delayed sternal closure and a prolonged hospital stay. Sixteen months later, the patient began to have recurrent anginal symptoms and frequent episodes of congestive heart failure, which culminated with this admission. A coronary angiogram showed a completely absent native circulation, two patent grafts to the right coronary system, a patent graft to an obtuse marginal branch, and the LITA, implanted in 1976, which precariously supplied the LAD system. The ejection fraction, as in the patient's previous operation, was calculated at 20%. The patient underwent an axillary artery–LAD bypass with a reversed lesser saphenous vein graft. No inotropic medications were needed, and the patient did not require any blood or blood components. The patient was kept in the intensive care unit overnight and was transferred to the regular department on the first postoperative day. Two days after the operation the patient was discharged from the hospital, receiving only nonprescription medication for pain. Two weeks after the operation, before the patient started a cardiac rehabilitation program, a Doppler study showed excellent function of the graft.

Operative technique. The left arm is abducted no more than 90 degrees. A 5 cm transverse incision is performed 2 cm below and parallel to the clavicle just lateral to the sternochondral junction. The pectoralis major muscle is split in an avascular plane between its clavicular and sternal heads. The first rib is identified and the intercostal muscles inserted in its inferior aspect are divided. A periosteal elevator is used to free the underside of the rib from the pleura. The subclavius, anterior scalene, and middle scalene muscles are carefully divided on top of the rib, gently retracting the axillary vessels. The rib is divided with a rongeur at the costochondral junction and then transected posteriorly with a rib shears. The axillary artery is circumferentially mobilized. A second 8 cm transverse incision is performed over the fourth costal cartilage. The cartilage is excised and the pericardium overlying the

From the Department of Cardiothoracic Surgery and Cardiology, St. Jude Medical Center, Fullerton, and the University of California, Irvine Medical Center, Orange, Calif.

Received for publication July 18, 1997; accepted for publication August 19, 1997.

Address for reprints: Eduardo A. Tovar, MD, 100 E. Valencia Mesa Dr., Suite 301, Fullerton, CA 92635.

J Thorac Cardiovasc Surg 1998;115:242-3

0022-5223/98 $5.00 + 0 **12/54/85525**

Fig. 1. Proximal anastomosis indicated by the *arrow.* The anterior portion of the first rib has been removed. (The patient is oriented cephalad to the right.)

LAD is opened and placed on traction by stay sutures. The pleura is entered at the apex to form the intrathoracic tunnel (Fig. 1). Heparin is given and a segment of the axillary artery is isolated with a small curved vascular clamp. The anastomosis is completed with 7-0 polypropylene suture (Fig. 1). Either a free arterial or venous graft can be used. Flow is restored to the upper extremity and the graft is passed though the tunnel. The LAD is snared proximally and distally and is stabilized with a retractor of choice. The arteriotomy is followed by completion of the anastomosis with the same suture material, and the flow to the distal vessel is restored. Heparin is partially reversed. The superficial fascia overlying the pectoralis muscle is reapproximated, as well as the skin. A chest drain is connected to a Heimlich valve, placed in the chest cavity, and removed immediately before completion of closure of the incision and after the lungs are overinflated.

Discussion. In 1959, Lewis[4] resected an abdominal aortic aneurysm. Being unable to anastomose the proximal end of a homograft to the abdominal aorta, he resected the middle third of the clavicle and sutured a nylon graft to the proximal axillary artery. He then brought the graft down the chest wall and into the abdomen for anastomosis with the homograft. This unorthodox approach marked the beginning of the axillary artery as an inflow source. In 1963, Blaisdell and Hall[5] reported Dacron grafts placed between the axillary and ipsilateral femoral arteries. Later, the axillary artery was used as the blood supply to bypass contralateral axillary and ipsilateral carotid arteries. To our knowledge, the axillary artery has never been used as the source of inflow to supply an intrathoracic structure. The reason is probably that there is no natural passage to reenter the chest cavity. Performance of a proximal anastomosis using the subclavian artery or the descending thoracic aorta as a source of inflow to revascularize the LAD or the circumflex arteries, respectively, is technically demanding. In addition, to gain access to these arteries a thoracotomy incision is necessary. The distal anastomosis of the LAD on a beating heart through a thoracotomy approach is also more difficult than through an anterior mediastinotomy. With the technique here described, patients remain in the supine position for both the proximal and distal anastomoses, allowing the distal one to be performed through an anterior mediastinotomy. The removal of the anterior portion of the first rib facilitates mobilization and exposure of the axillary artery, the proximal anastomosis is thus technically easy, and the incision produces minimal discomfort. In addition, construction of this anastomosis does not interfere with a patent LITA. A free arterial graft or a venous conduit can be used, and they can be easily evaluated noninvasively by Doppler studies. Obviously, subclavian sticks are contraindicated in these patients.

REFERENCES

1. Demikhov VP. Experimental transplantation of vital organs (authorized translation from the Russian). New York: Consultants Bureau Enterprises; 1962. p. 220-7.
2. Kolesov VI, Potashov LV. Operations on the coronary arteries. Exp Chir Anaesth 1965:10:3-8.
3. Fanning WJ, Kakos GS, Williams TE Jr. Reoperative coronary artery bypass grafting without cardiopulmonary bypass. Ann Thorac Surg 1993;55:486-9.
4. Lewis CD. A subclavian artery as the means of blood supply to the lower half of the body. Br J Surg 1961;48:574-5.
5. Blaisdell FW, Hall AD. Axillary femoral artery bypass for lower extremity ischemia. Surgery 1963;54:563-8.